

## Carrot-Saskatchewan River Watershed characterization report

Surface water management in the Carrot-Saskatchewan River watershed tends to consist largely of natural waterways, retention, and agricultural drainage in the area of land that contributes water to the Carrot and Saskatchewan Rivers and their tributaries. The watershed is comprised of two major drainage systems run by the Carrot River and Saskatchewan River and their tributaries.

The overall landscape in this watershed is a combination of high, low and flat lands and contains a number of lakes and marshes. The major issues in this watershed associated with the surface water are flooding, drainage, bank sliding, and retention. Ice jamming in some waterways aggravates the flooding of the farmlands. Lakes in watershed 114 are the major natural wetlands in this watershed; these are considered to be natural water retention areas. Due to the existence of numerous water bodies and retention areas, and also due to the highland and lowland topography, flooding and drainage are the significant concerns in this watershed. Consequently, surface water management has become a great challenge in this watershed.

As there is less agricultural activity in this watershed compared to southern Manitoba, agricultural drainage is less important and therefore surface water management mainly involves flooding issues.

### WATERSHED CHARACTERISTICS

The Carrot-Saskatchewan River watershed planning areas consists of one watershed (WS), and its designated number is 114. The entire watershed area is shown in Figure 1. The notable water bodies and infrastructures in the sub-watershed are listed in Table 1.

**Table 1:** Water bodies and Infrastructures in the Carrot-Saskatchewan River Watershed

Watershed	Waterway (River/Creek/Drain)	R.M. concerned/Important places (Infrastructures/Projects/Retentions/Forests)
Carrot-Saskatchewan River (WS # 114)	Carrot River, Saskatchewan River, Pasquia River, Elm Creek, Culdesac River, Big Lake Drain, Pasquia Lake Drain, Birch/Saskeram River, Ralls Creek, Z Drain, Q drain, Summer Berry River, Ranchers Creek, Head River, Rocky Creek	RMs: Kelsey, LGD Consol, Cranberry Portage  Pasquia River Control Structure, Ralls Creek Control Structure, Grace Lake Control Structure, Victor Jory Pumping Station, Knapp Dam on Pasquia River, Big Lake Control Structure, Carrot River Pumping Station, Big Bend Dam, Big Bend Dyke, The Pas Pumping Stations,  Pasquia River Diversion/Dam at 27-53-29W. Rocky Lake Provincial Park

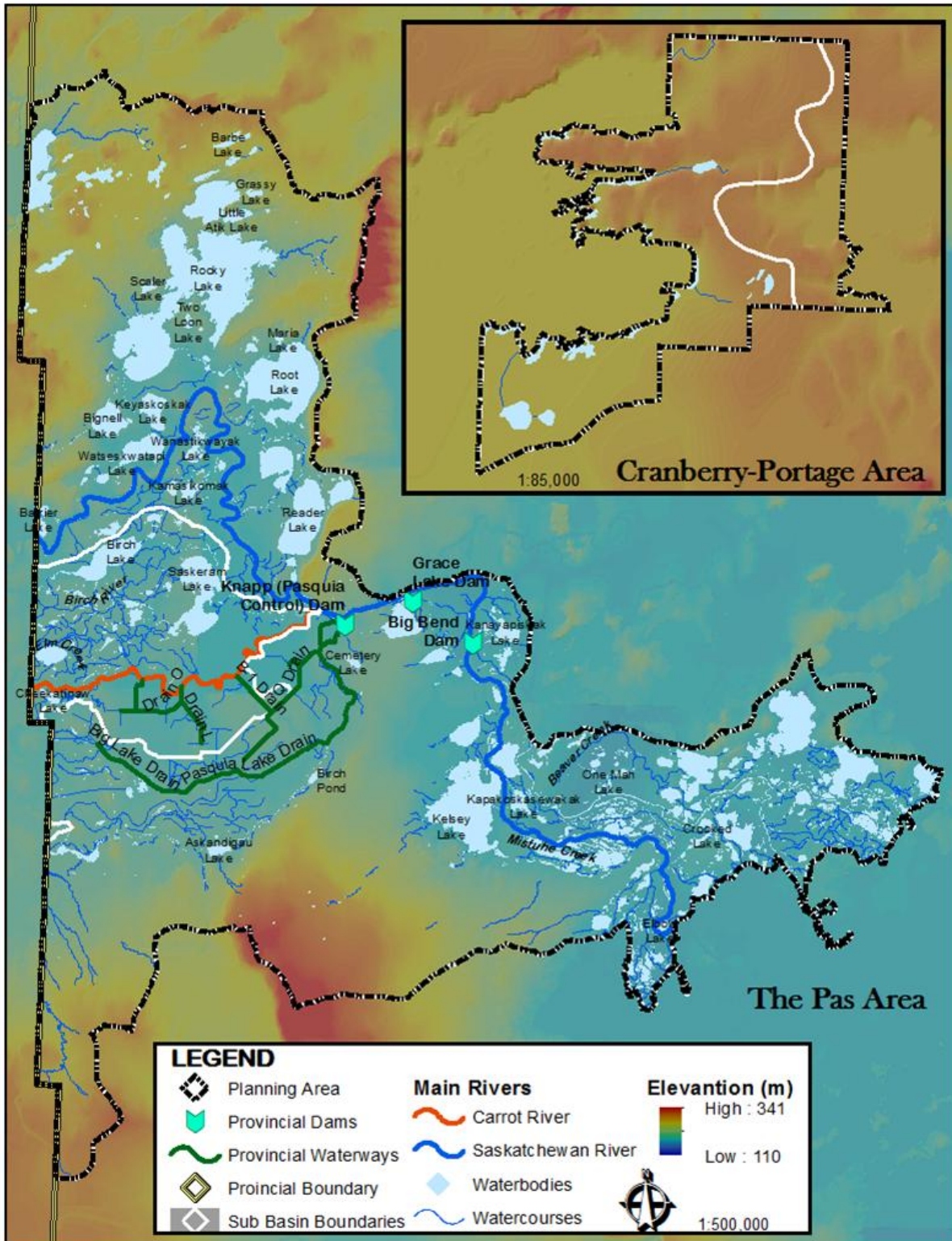


Figure 1: Watershed map

The portion of the Carrot-Saskatchewan River basins within Manitoba is nearly 4800 km<sup>2</sup> in size. The Carrot River basin has a area of approximately 630 km<sup>2</sup> and drains the northeastern slopes of the Pasquia Hills. The Carrot River flows in a north-easterly direction, from the Saskatchewan border, to where it joins the Saskatchewan River near The Pas. The Saskatchewan River basin has a area of approximately 3332 km<sup>2</sup> between The Pas area and the Cranberry-Portage area. Water flows eastward into the Carrot-Saskatchewan system from the border. The Saskatchewan River flows in a south-easterly direction across the watershed where it enters Lake Winnipeg near Grand Rapids. The Pasquia River basin has a gross drainage area of approximately 830 km<sup>2</sup> and drains in a northerly direction towards the Saskatchewan River near The Pas.

The Carrot-Saskatchewan River basin is generally sloped toward the south-east and flows into Lake Winnipeg's Limestone Bay near the Grand Rapids. The upper reaches of the watershed are more steeply sloped with flatter slopes in the middle and lower reaches. The overall gradient of the Carrot -Saskatchewan River consists of a 0.03 % to 0.05 % slope. The watershed contains extensive areas of poorly drained land and swamps predominantly in the upper reaches of the Saskatchewan River watershed. The steep slopes in the upper reaches of the Saskatchewan River often result in high runoff peaks in the vicinity of the Carrot River causing flooding. The Carrot-Saskatchewan River watershed is located in a predominantly agricultural area.

The Saskatchewan River is made up of two main branches, called the North Saskatchewan and the South Saskatchewan. Both rivers have their source in the Rocky Mountains and flow across the prairies. Some thirty miles east of Prince Albert, the North and South Saskatchewan Rivers join and form the Saskatchewan River. Below the junction, the river spreads out in broad, swift stretches, with several rapids and many sand bars. The average gradient between the Forks and Tobin Rapids, which is about 120 kilometer to the east, is approximately 0.00045. The Tobin Rapids, followed by the smaller Squaw Rapids where the river drops approximately 15 meter, form the division between the rapidly sloping land to the west and the flat marsh lands to the east. The average gradient of the river between Tobin Rapids and The Pas is 0.00007. At The Pas, the Saskatchewan River narrows down and passes through a gravel ridge. Below this ridge the river again broadens out, and continues its course through a low, flat delta area to Cedar Lake, maintaining a slope of 0.000048.

Flows on the Saskatchewan River at the Pas have been affected by upstream regulation between 1913 to 1984. Since 1962, the natural flow regime has been modified by the construction of the Gardiner Dam at Lake Diefenbaker and the Tobin Reservoir in the Saskatchewan and Bighorn reservoir in Alberta.

The Sipanok Channel in Saskatchewan, an overflow channel towards the Carrot River, starts to flow when the Saskatchewan flow exceeds 40,000 cfs. The Saskatchewan River, where it joins the Carrot and Pasquia, is broad, deep and meandering.

There are many streams draining into the Carrot and the Saskatchewan River. The main tributaries of the Saskatchewan River are the Carrot River, and the Pasquia River. At a point 24 kilometer downstream from The Pas, the Saskatchewan River divides into the Summerberry River and the Saskatchewan River. The main tributaries of the Carrot River are the Birch/Saskeram River, Culdesac River (Salt Channel). These streams account for approximately 5 % of the total drainage area. There are about 95 km of provincial waterway drains in this watershed. About 40 % of the basin area is lakes, marshes and wetlands.

There are numerous lakes that exist in this watershed. Significant lakes in this watershed are listed in Table 2:

Watershed	Lakes
Carrot-Saskatchewan River (WS # 114)	Kelsey Lake, Little Kelsey Lake, Montreal Lake, Grace Lake, Birch Lake, Saskeram Lake, North Mistuhe Lake, Cheekatinaw Lake, Big Lake, Pasquia Lake, Makenzie Lake, Askandigau Lake, Cemetery Lake, Reader Lake, Freshford Lake, Kanayapiskak Lake, Kapakoskewakak Lake, One Man Lake, Ravensnest Lake, Red Earth Lake, Red Rock Lake, Elbow Lake, Trader’s Lake, Lamb Lake, Long Grass Lake, Crooked Lake, Bittern Lake, Poplar Point Lake, Rocky Lake, Keyaskoskak Lake, Kakeyaskooskak Lake, Kamasikomak Lake, Scaler Lake, Two Loon Lake, Little Atik Lake, Grassy Lake, Barbe Lake, Jed Lake, Maria Lake

The soils of the Saskatchewan River delta area are poorly to imperfectly drained, subject to more frequent periodic flooding. Natural drainage is slow due to the extreme flatness of the area and the damming effect of the levees along the rivers and streams. The soils in the Moose Lake area are alluvial deposits which are poorly drained and good for agriculture. The soils are more suitable for agriculture than those in the Carrot River Area.

The notable water control infrastructures in this watershed are a number of dams and reservoirs, water control structures, diversions, bridges, culverts, etc.

## **MAJOR SURFACE WATER ISSUES IN THE WATERSHED**

The major issues/matters related to surface water in this watershed is flooding and erosion.

Flooding in Manitoba typically occurs from spring snowmelt runoff, which is aggravated in some locations by ice jams and coincidental heavy rainstorms. Most recently, many areas of southern Manitoba experienced flooding due to high river flows, major ice jams and ice-blocked drainage systems in the spring. In addition to spring flooding, more localized flooding can also occur during the summertime due to unusually heavy summer rainstorms. In the last 15 years, various parts of southern Manitoba experienced unusually heavy rain falls, which resulted in summer flooding. As well, flooding does occur along some of Manitoba’s lakes, when inflows are high and lake levels go up and, as in the case of Lake Winnipeg and Lake Manitoba, strong northerly winds result in significant wave setup and wave up-rush. Beaver dams, trees, brush and debris aggravates the flooding problems in the waterways.

Spring flooding along the Carrot-Saskatchewan Rivers was noticed in the past in significantly different locations. The land south of the Carrot River is relatively low and subject to flooding. Dyking along the Carrot River was completed in 1956. Ralls Island is an area located approximately 5 kilometers east of the Town of The Pas. Ralls Island is a relatively low area. The Saskatchewan River flows around the Ralls Island area from west to northwest between sections 20-56-15W and 25-56-15W. In the past, much of the area was susceptible to spring flooding by the Saskatchewan River, but due to hydrologic changes in the river, the addition of drainage ditches and controls, flooding has been mitigated.

Between The Pas and Cedar Lake, the Saskatchewan River overflows its banks at various places into marshes and small lakes. Ralls Island was flooded in 1948 and 1953. Following major flooding in the Ralls Island area east of The Pas in 1948 and 1953, Ralls Island dykes were constructed along Ralls Creek at sections 13, 14, 20, 21, 22-56-25W by the province to provide protection for agricultural lands. Dyke construction was started in 1961 for flood protection.

The Saskatchewan River bank at Ralls Island was subjected to erosion. An erosion problem was found along PR 285 at Ralls Island in The Pas.

## **MAJOR SURFACE WATER INFRASTRUCTURES IN THE WATERSHED**

### **Diversions**

The Pasquia River diversion was constructed through the Salt Channel. Protection of the eastern area through a dyke along the south banks of the Saskatchewan and Carrot Rivers were established with this diversion. The Pasquia Diversion Dam was constructed in section 26-53-29W in 1954.

Another diversion was constructed in 1960 on the Pasquia River at section 55-26W.

The Salt Channel-Carrot River diversion was constructed between the Salt Channel and Carrot River. The diversion construction was started in 1953/1954 and completed in 1958.

### **Dikes**

Saskatchewan River dikes in the Ralls Island were reconstructed and other flood protection for a 1 in a 100 year flood situation was carried out for at-risk properties along the Carrot River in 2011.

### **Retention**

Big Lake drains into the Carrot River; Big Lake and Pasquia Lake act as storage reservoir drains through control structure no. 1 and 2 into the Pasquia River. Big Lake was developed as a spring runoff storage reservoir in section 20-54-28W to facilitate water management in this area during high spring runoff. The Big Lake control structure was constructed to develop Big Lake Reservoir. Stored water is released via the Pasquia Lake Drain during the summer and fall months.

### **Provincial Dams**

There are numerous water control structures in The Pas area. In 1968, control structures along the Summerberry and Saskatchewan Rivers east of The Pas were undertaken, such as Big Bend Dam, Ravensnest Dam, Crooked Lake Dam, Red Rock Dam, Amisk Dam, Red Earth Dam, Traders Lakes Dam, and Two Island Dam.

Big Bend Dam (pipe inlet) is a stop log dam constructed in section 1-56-25W by the province in the early 1950's, and the province maintains this dam.

The Pasquia River Control Dam and sluiceway were constructed to prevent the Saskatchewan River from backing up into the Pasquia River. The Pasquia Control Dam is located at the mouth of the Pasquia River, just downstream of the Knapp Dam built in 1941 by the Dominion Government in cooperation with Ducks Unlimited. The control on the Pasquia Dam consists of four 6 ft diameter multi-plate pipes with slide gates. The control structures were built (1) to control the water entering Pasquia Lake and (2) to control the outflow from Big Lake, which was used as a storage reservoir.

Grace Lake Dam (pipe inlet) was built in section NE 19-56-25W by the province. This dam is operated and maintained by the province.

Ralls Island Dam was built in section NE 14-56-25W by the province. This dam is operated and maintained by the province.

Pierson Dam was constructed adjacent to the Red Earth and Driftwood Lakes Dam.

Trader's Lake Dam was built in section SW24-54-21W by the province in 1941. This dam is operated and maintained by the province.

Red Rock Dam was built in section 8-54-22W by the province during 1936/37. This dam is operated and maintained by the province.

The Crooked Lake Intake Structure was built in section SW 5-54-22W by the province in 1953. This dam is operated and maintained by the province.

### **Ducks Unlimited Dams**

The Pasquia River Control Structure (Knapp Dam) is a stop-log dam that was constructed in 1941 on the Pasquia River by Ducks Unlimited to control the waters of Pasquia Lake, and to improve the area for waterfowl. This dam holds back the Saskatchewan flood waters up to a certain stage.

Carrot River Triangle Dam was constructed in section NW 34-56-28W by Ducks Unlimited. Currently, Ducks Unlimited maintains this dam.

Elm Creek Dam was constructed in section 9-56-28W by Ducks Unlimited. Currently, Ducks Unlimited maintains this dam.

Birch Lake Dam was constructed in section NW 34-56-28W by Ducks Unlimited. Currently, Ducks Unlimited maintains this dam.

Bracken Dam was constructed on the Saskeram/Birch River in 1941 in section NE 12-56-27W at the mouth of the Saskeram to hold water in the marshes for wildlife conditions, but is now used for flood control. Ducks Unlimited built and maintains this dam.

Red Earth Lake Dam was constructed in section 16-54-22W by Ducks Unlimited. Currently, Ducks Unlimited maintains this dam. DU assumed responsibility for it in 1972.

Driftwood Lakes Dam was constructed in section 16-54-22W by Ducks Unlimited. Currently, Ducks Unlimited maintains this dam.

Upper Hill Island Control Structure was constructed in section SW 1-54-24W by the province, and this dam is operated by Ducks Unlimited.

Lake 8 (Kelsey Lake) Intake Control Structure was constructed in section SW 32-53-24W by the province, and this dam is operated by Ducks Unlimited.

A rock filled crib (dam) was constructed at the outlet of Lake 18 in section 52-23W.

Ravensnest Lake Dam was constructed in section NE 30-54-24W in 1942 by Ducks Unlimited. Currently, Ducks Unlimited maintains this dam.

Amisk Dam was constructed in section S 11-54-23W by the province. Currently, Ducks Unlimited maintains this dam.

The Rocky Creek Control Structure is located in northern Manitoba, approximately 30 km north of The Pas and 5 km west of Highway 10. The control structure (a wooden structure) and fishway were originally built by Ducks Unlimited Canada in 1947, in cooperation with the Province of Manitoba, to enhance muskrat and waterfowl habitat in Rocky Lake, and in Reader Lake and Root Lake downstream. In 1951, Ducks Unlimited installed a fish ladder beside the control structure at the request of the province. By 1974 the original timber dam had reached the end of its lifespan, and Ducks Unlimited replaced the original wooden structure and fishway. The current structure was built in 1991 with the cooperation and approval of the Manitoban government. The present structure, including a 10 chamber vertical slot fishway, consists of corrugated steel plates and gravel substrate in the bottom of each chamber.